Final Bathymetric Survey for Armor Stone Layer

PREPARED FOR: de maximis, inc.

COPY TO: File

PREPARED BY: CH2M HILL

DATE: May 8, 2014

Introduction

Following installation of the Sand/AquaGate+PAC™ layer, a single layer of a non-woven 100% plastic high strength geotextile was installed followed by the placement of armor stone. In accordance with Technical Specification Section 023200 (Paragraph 3.05D) the armor stone was to have a minimum thickness of 10 inches and a minimum average thickness of 12 inches for those areas where the cap was placed as designed. In the areas where high subgrade material was encountered, and a modified cap was placed, the armor stone was to have a minimum thickness and minimum average thickness of 4.5 inches and 6 inches, respectively. The purpose of this technical memorandum is demonstrate that the final armor stone elevation meets the intent of the technical specifications.

Bathymetric Survey Results

The final bathymetric surveys for the armor rock layer were conducted April 29 through May 3, 2014. This data was compared to the surveys conducted after the active layer was placed in order to determine the thickness of the armor stone layer. The results of this comparison demonstrate that the minimum thickness of 10 inches (4.5 inches for modified cap areas) was achieved in all areas and the average thickness of the armor stone is 1.27 feet (15.2 inches). These comparison surveys are provided as Attachment #1.

The technical specification required a maximum average thickness of 24 inches in order to ensure that the final cap elevation did not exceed the pre-dredge surface elevations. A comparison of the pre-dredge surface to the final armor stone elevations indicates that the cap is an average of 1.2 inches greater than the pre-dredge surface. The results of this comparison are provided as Attachment #2.

A summary of the survey comparisons broken down by the areas upriver and downriver of the No Dredge Zone is provided below in Table 1. A summary of the settlement plate data is provided in Table 2.

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Table 1 – Summary of Survey Comparisons

SURFACE COMPARISON	AVERAGE THICKNESS (INCHES)		
	Downriver of No Dredge Zone	Upriver of No Dredge Zone	Overall Cap
Post Active Layer to Post Armor Rock Layer	15.4	15.0	15.2
Pre Dredge Surface to Post Armor Rock Layer	1.1	1.2	1.2
Post Dredge Surface to Post Armor Rock Surface	25.8	25.6	25.7

Table 2 – Summary of Settlement Plate Data

PLATE ID	SETTLEMENT (INCHES)
UPRIVER OF NO DREDGE ZONE	
Plate #1	2.3
Plate #2	4.1
Upriver Average Settlement	3.2
DOWNRIVER OF NO DREDGE ZONE	
Plate #3	2.4
Plate #4	1.8
Downriver Average Settlement	2.2
OVERALL AVERAGE	2.7

Conclusions

The bathymetric surveys indicate that the minimum thickness of armor stone (4.5 or 10 inches) has been placed in accordance with the requirements of the technical specifications. However, the

average thickness of the cap was determined to be an average of 25.7 inches which exceeds the allowable maximum average thickness of 24 inches. The purpose of the 24 inch maximum thickness requirement was to minimize the potential for the final average cap elevation to exceed the pre-dredge sediment surface. However, when the armor stone elevation is compared to the pre-dredge surface elevation the cap only exceeds the pre-dredge surface by an average of approximately 1.2 inches.

While the armor stone surface is slightly higher than the pre-dredge surface, the final elevation is considered acceptable and no further actions are required for the following reasons:

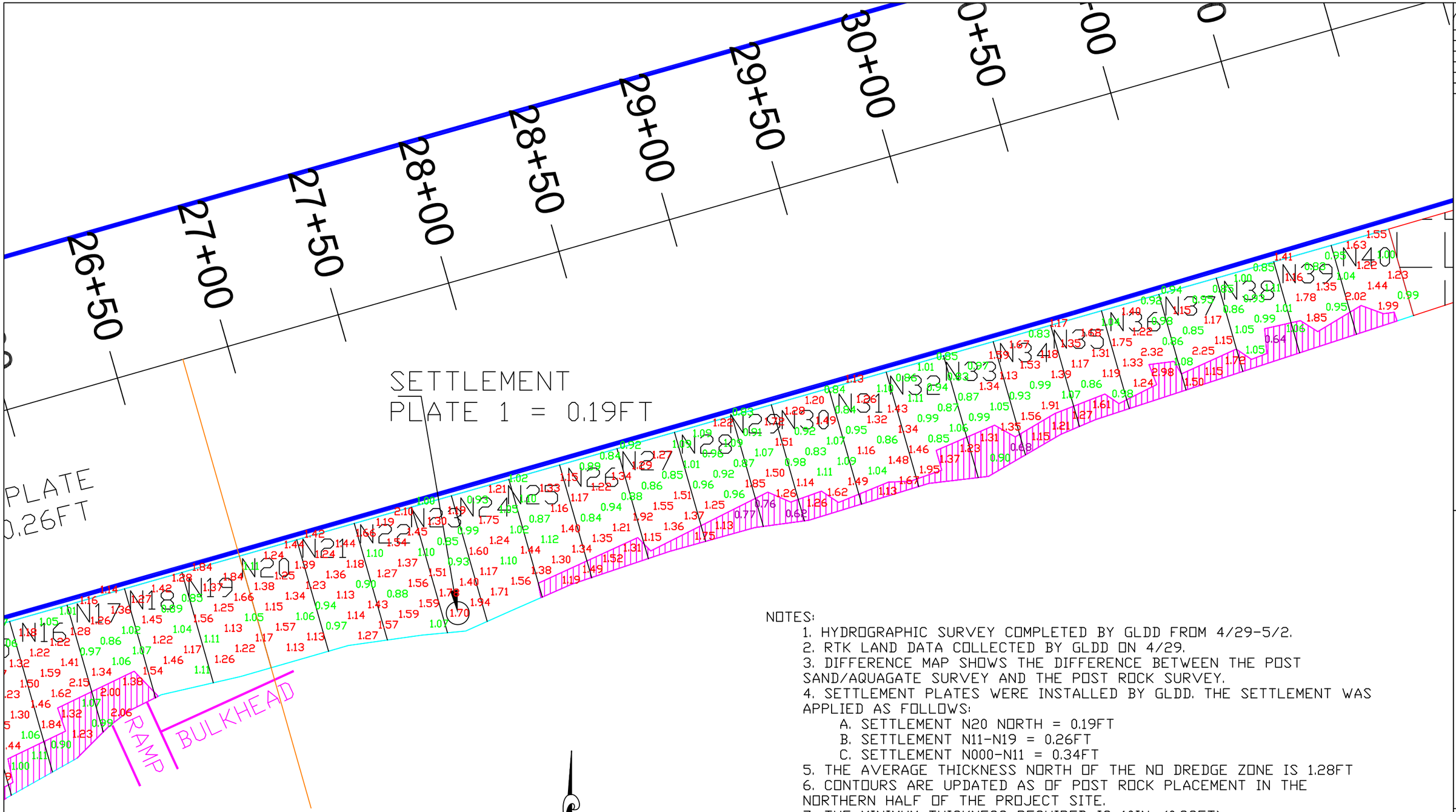
- Additional Cap Settlement - Settlement data ranges from 2.2 to 4.1 inches and the upriver and downriver areas average 3.2 and 2.7 inches, respectively. This data indicates that additional cap settlement is likely. Therefore, the differential between the pre-dredge and final armor stone surface will continue to decrease over time.

- Variability in Stone Size: At least 50% of the armor layer is made up of stone which ranges in size from 5 to 7 inches with some stone measuring up to 9 inches. Therefore, given the variability in the size of the stone the 1.2 inch differential is not considered to be unreasonable.

- Potential Damage to Cap: The corrective actions which may be required to reduce the 1.2 inch differential could potentially result in damage to the geotextile fabric. The risk of damage to the cap is considered to be much greater than the potential risk of flooding as a result of the final cap surface being 1.2 inches greater than the pre-dredge surface.

Attachment #1

Armor Stone Thickness Surveys



NOTES:

1. HYDROGRAPHIC SURVEY COMPLETED BY GLDD FROM 4/29-5/2.
2. RTK LAND DATA COLLECTED BY GLDD ON 4/29.
3. DIFFERENCE MAP SHOWS THE DIFFERENCE BETWEEN THE POST SAND/AQUAGATE SURVEY AND THE POST ROCK SURVEY.
4. SETTLEMENT PLATES WERE INSTALLED BY GLDD. THE SETTLEMENT WAS APPLIED AS FOLLOWS:
   - A. SETTLEMENT N20 NORTH = 0.19FT
   - B. SETTLEMENT N11-N19 = 0.26FT
   - C. SETTLEMENT N000-N11 = 0.34FT
5. THE AVERAGE THICKNESS NORTH OF THE NO DREDGE ZONE IS 1.28FT
6. CONTOURS ARE UPDATED AS OF POST ROCK PLACEMENT IN THE NORTHERN HALF OF THE PROJECT SITE.
7. THE MINIMUM THICKNESS REQUIRED IS 10IN. (0.83FT)
8. THE MINIMUM THICKNESS IN THE HIGH SUBGRADE AREA IS 4.5IN. (0.375FT)

ROCK THICKNESS
< 0.49'
0.50'-0.82'
0.83'-1.12'
>= 1.13'

GRAPHIC SCALE

40 0 20 40 80 160

(IN FEET)
1 inch = 40 ft.

LEGEND
REMOVAL AREA
CHANNEL
HIGH SUBGRADE

REVISIONS	
DESCRIPTION	DATE

GREAT LAKES DREDGE AND DOCK COMPANY, LLC
2122 York Road Oak Brook IL 60521
CIVIL ENGINEERING/ SURVEYING DIVISION
Phone: 630.574-3000 Fax: 630.574-1515

PROJECT
LOWER PASSAIC RIVER, NJ
STUDY AREA PROJECT, RIVER MILE 10.9

TITLE/SURVEY TITLE
POST SAND - POST ROCK DIFF PG1

SCALE:	1:40
DATE:	MAY 3, 2014
GLDD JOB NO:	15368
USACE JOB NO:	NA
FILE NAME:	
DESIGNED BY:	J. MILLER III
APPROVED BY:	J. MILLER III

PAGE
01
OF 01 PAGES

SETTLEMENT PLATE
AVERAGE = 0.26FT

SETTLEMENT
PLATE 2 = 0.34FT

23+50
23+00
22+50
22+00
21+50

N000 N0 N1 N2 N3 N4 N5 N6 N7 N8 N9 N10 N11 N12 N13 N14 N15 N16 N17 N18 N19 N20 N21 N22

RAMP

BULKHEAD

NO DREDGE ZONE

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SCALE:	1:40
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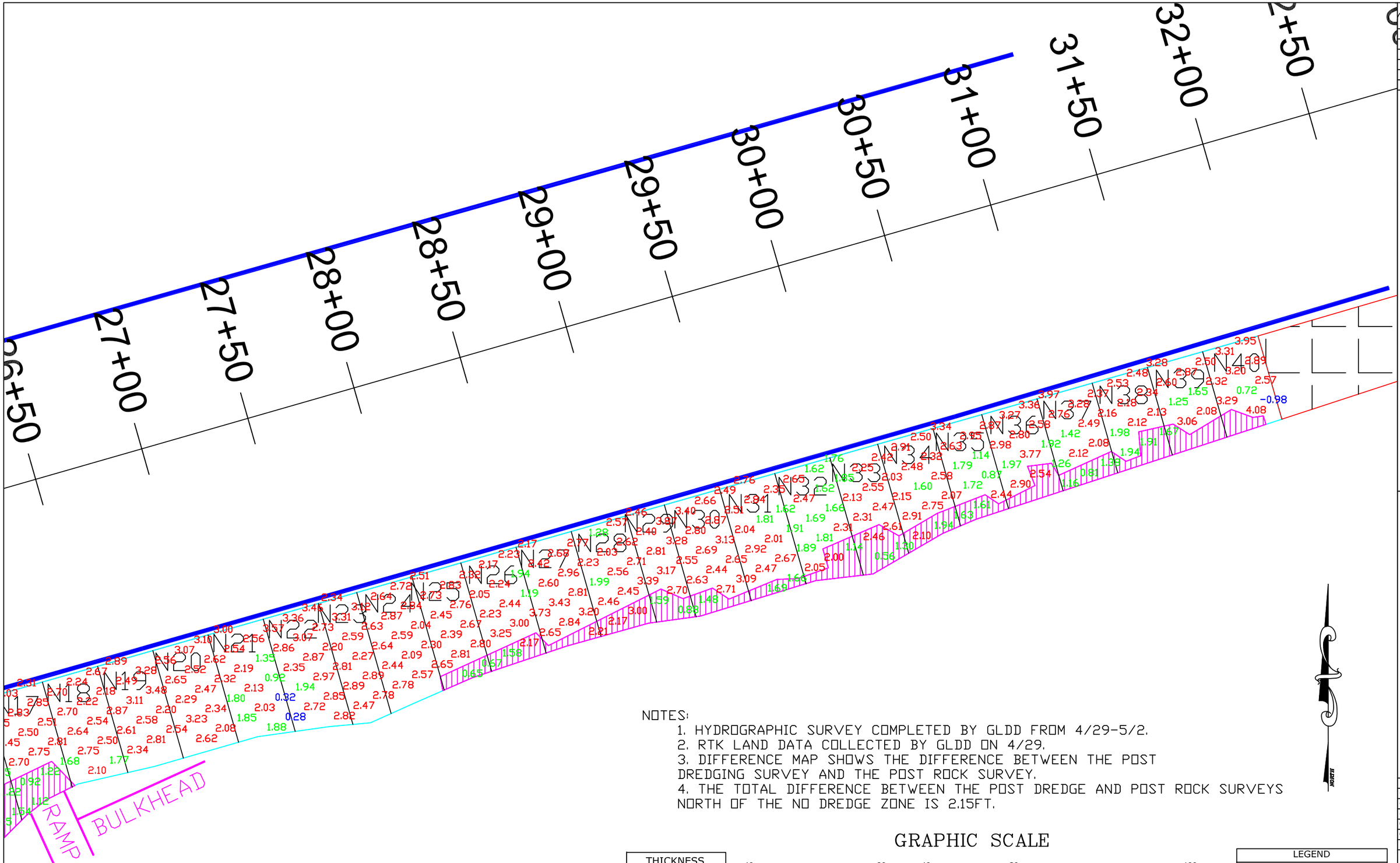

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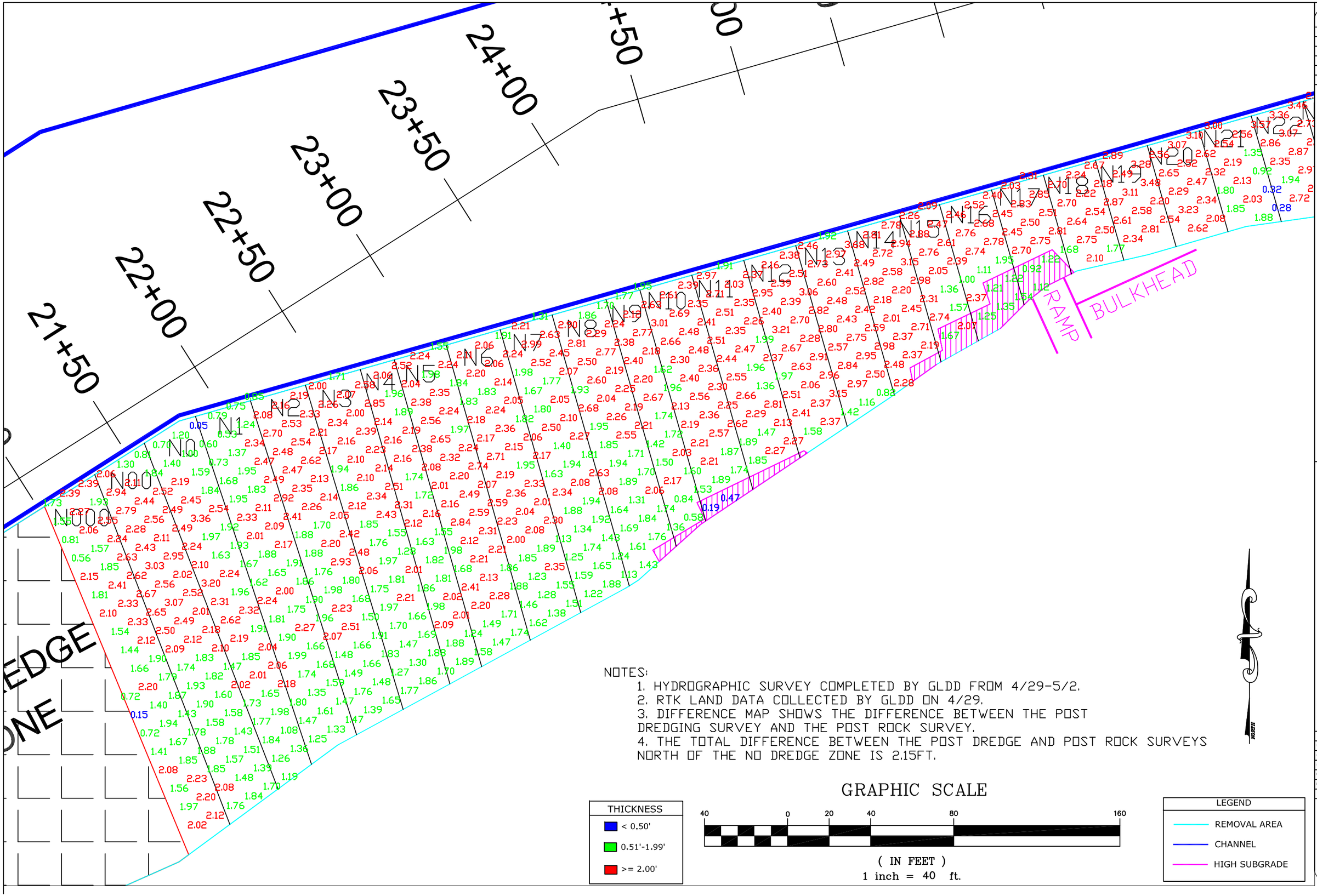

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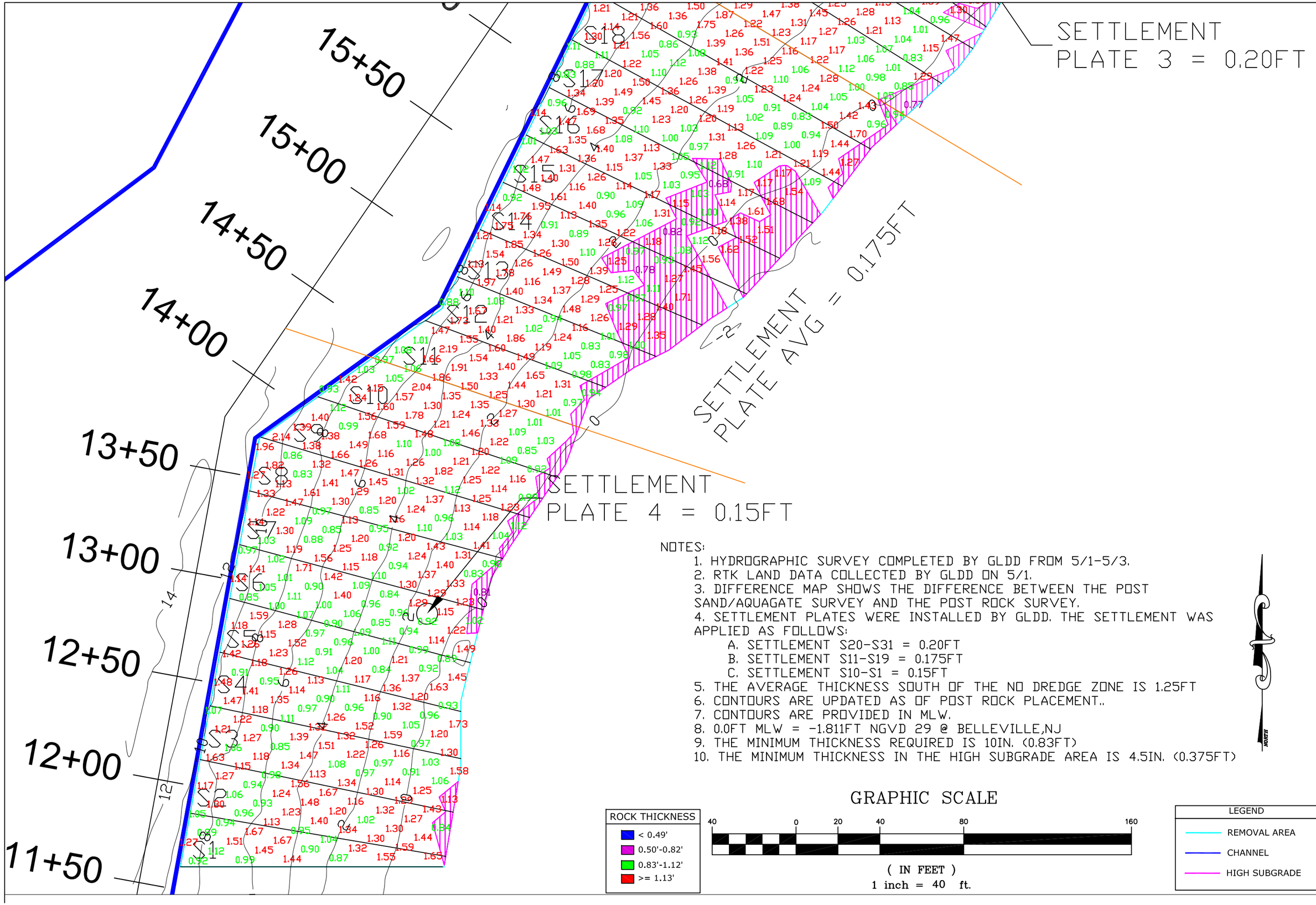

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   A. SETTLEMENT S20-S31 = 0.20FT
   B. SETTLEMENT S11-S19 = 0.175FT
   C. SETTLEMENT S10-S1 = 0.15FT
5. THE AVERAGE THICKNESS SOUTH OF THE NO DREDGE ZONE IS 1.25FT
6. CONTOURS ARE UPDATED AS OF POST ROCK PLACEMENT..
7. CONTOURS ARE PROVIDED IN MLW.
8. 0.0FT MLW = -1.811FT NGVD 29 @ BELLEVILLE,NJ
9. THE MINIMUM THICKNESS REQUIRED IS 10IN. (0.83FT)
10. THE MINIMUM THICKNESS IN THE HIGH SUBGRADE AREA IS 4.5IN. (0.375FT)

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POST SAND - POST ROCK DIFF SOUTH PG1

SCALE:	1:40
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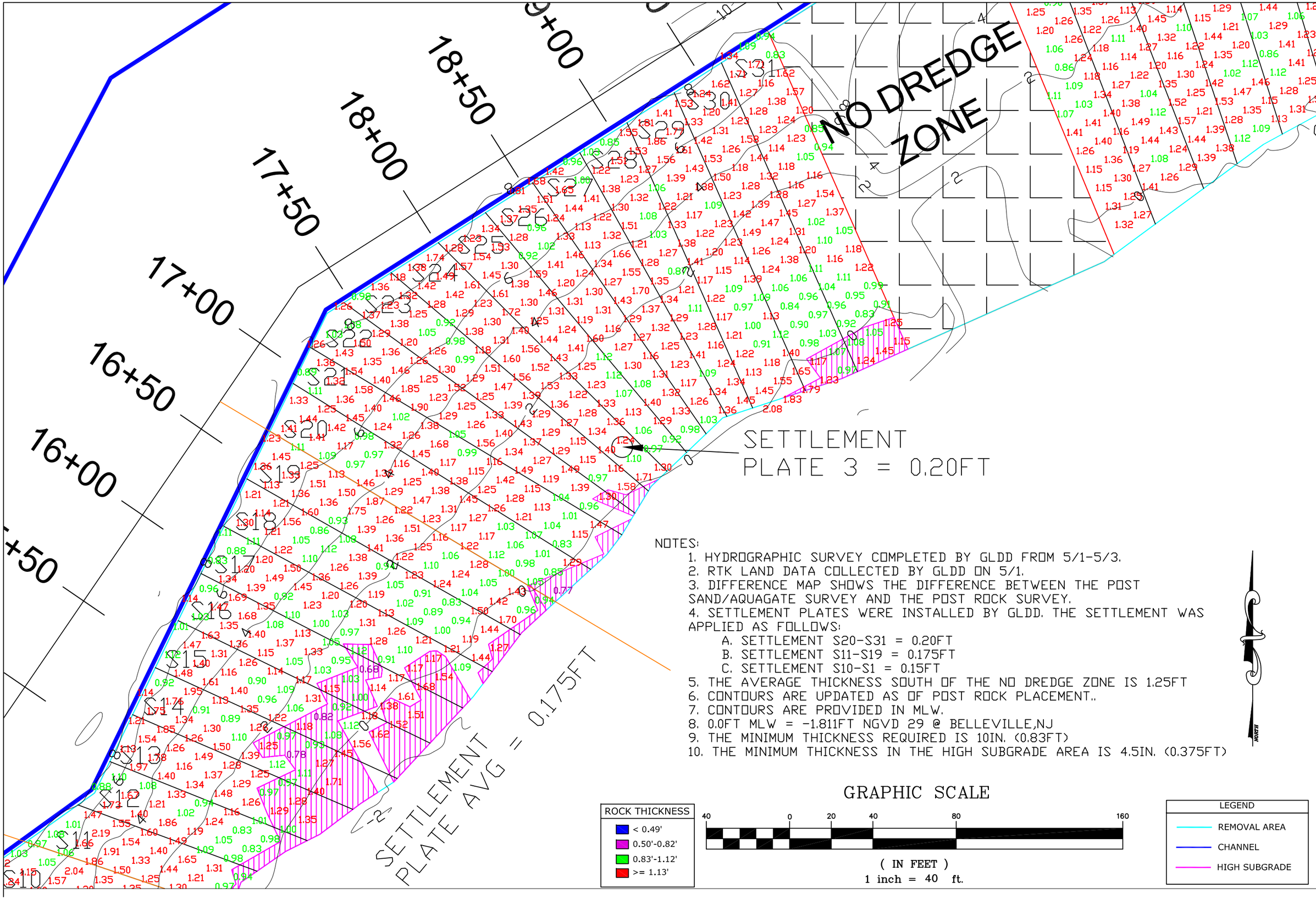

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TITLE/SURVEY TITLE
POST SAND - POST ROCK DIFF SOUTH PG2

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15+50
15+00
14+50
14+00
13+50
13+00
12+50
12+00
11+50

SETTLEMENT
PLATE AVG = 0.175FT

SETTLEMENT
PLATE 4 = 0.15FT

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POST DREDGE - POST ROCK SOUTH PG1

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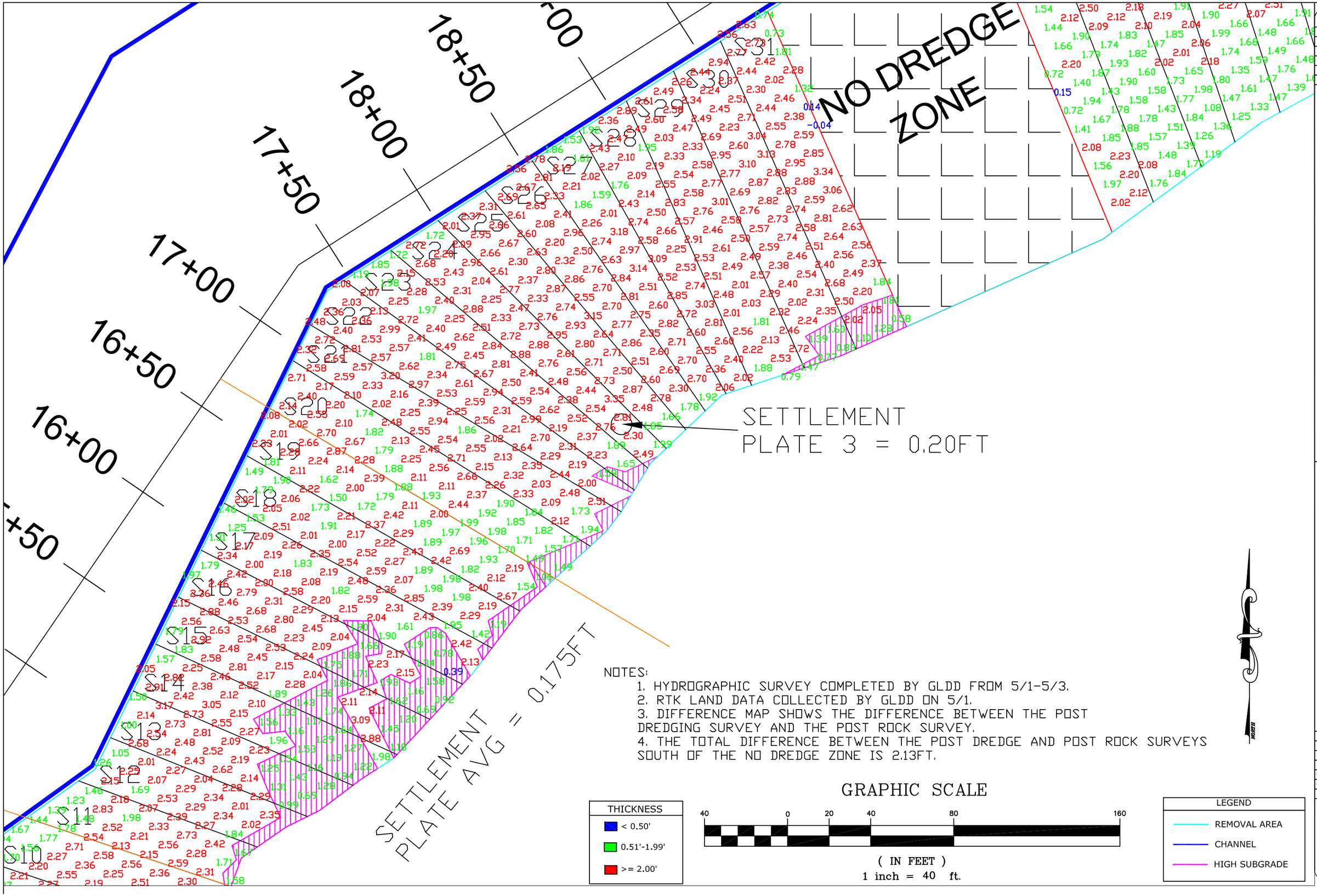

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TITLE/SURVEY TITLE
POST DREDGE - POST ROCK SOUTH PG2

SCALE:	1:40
DATE:	MAY 4, 2014
GLDD JOB NO:	15368
USACE JOB NO:	NA
FILE NAME:	
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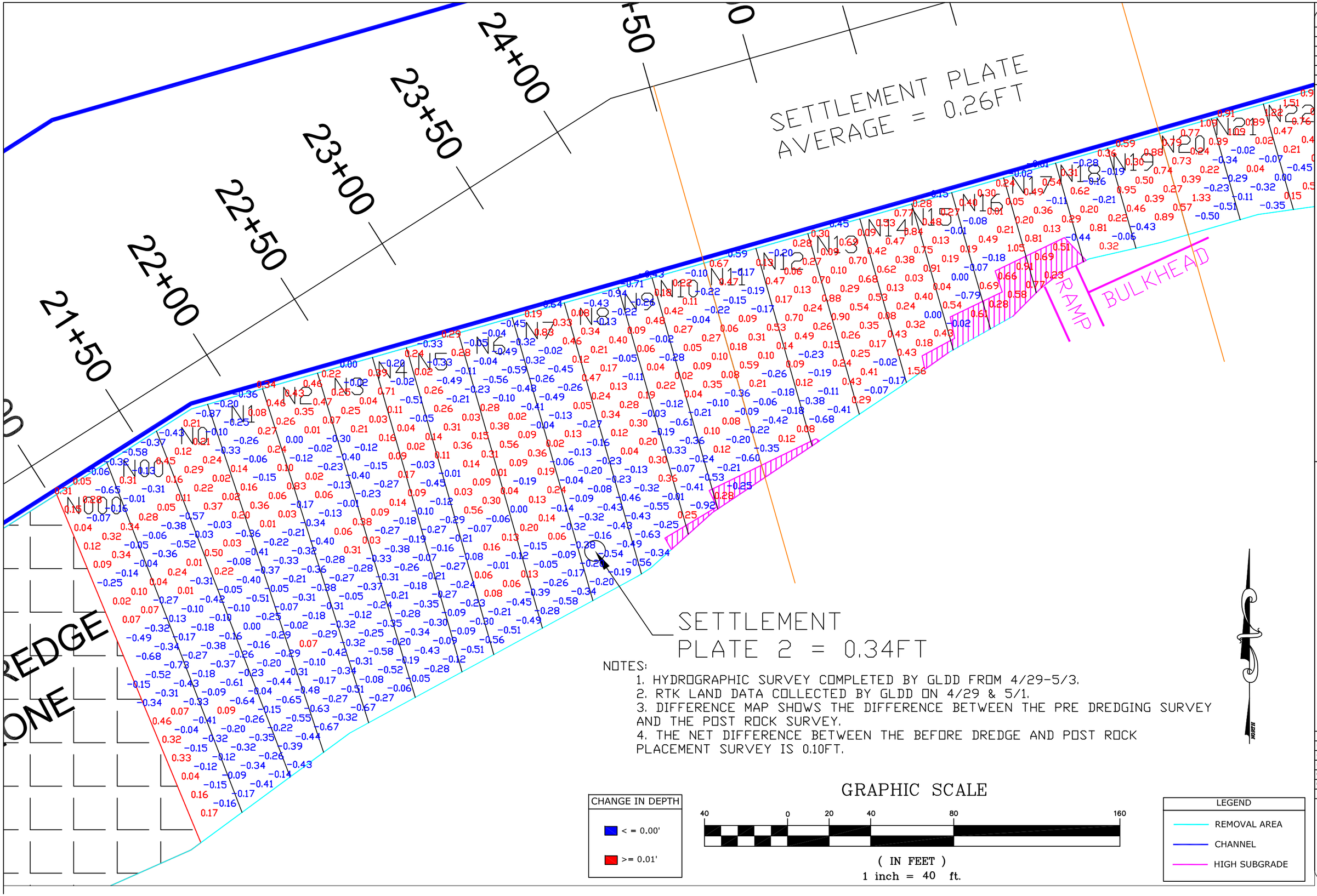
Attachment #2

Comparison of Pre-Dredge and Post Armor Stone Surveys



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4. THE NET DIFFERENCE BETWEEN THE BEFORE DREDGE AND POST ROCK PLACEMENT SURVEY IS 0.10FT.

CHANGE IN DEPTH

- < = 0.00'
- >= 0.01'

GRAPHIC SCALE

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(IN FEET)
1 inch = 40 ft.

LEGEND

- REMOVAL AREA
- CHANNEL
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TITLE/SURVEY TITLE
PRE DREDGE TO POST ROCK PG3

SCALE:	1:40
DATE:	MAY 6, 2014
GLDD JOB NO:	15368
USACE JOB NO:	NA
FILE NAME:	
DESIGNED BY:	J. MILLER III
APPROVED BY:	J. MILLER III

PAGE 01 OF 01 PAGES

15+50

15+00

14+50

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13+50

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SETTLEMENT
PLATE AVG = 0.175FT

SETTLEMENT
PLATE 4 = 0.15FT

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PRE DREDGE TO POST ROCK PG1

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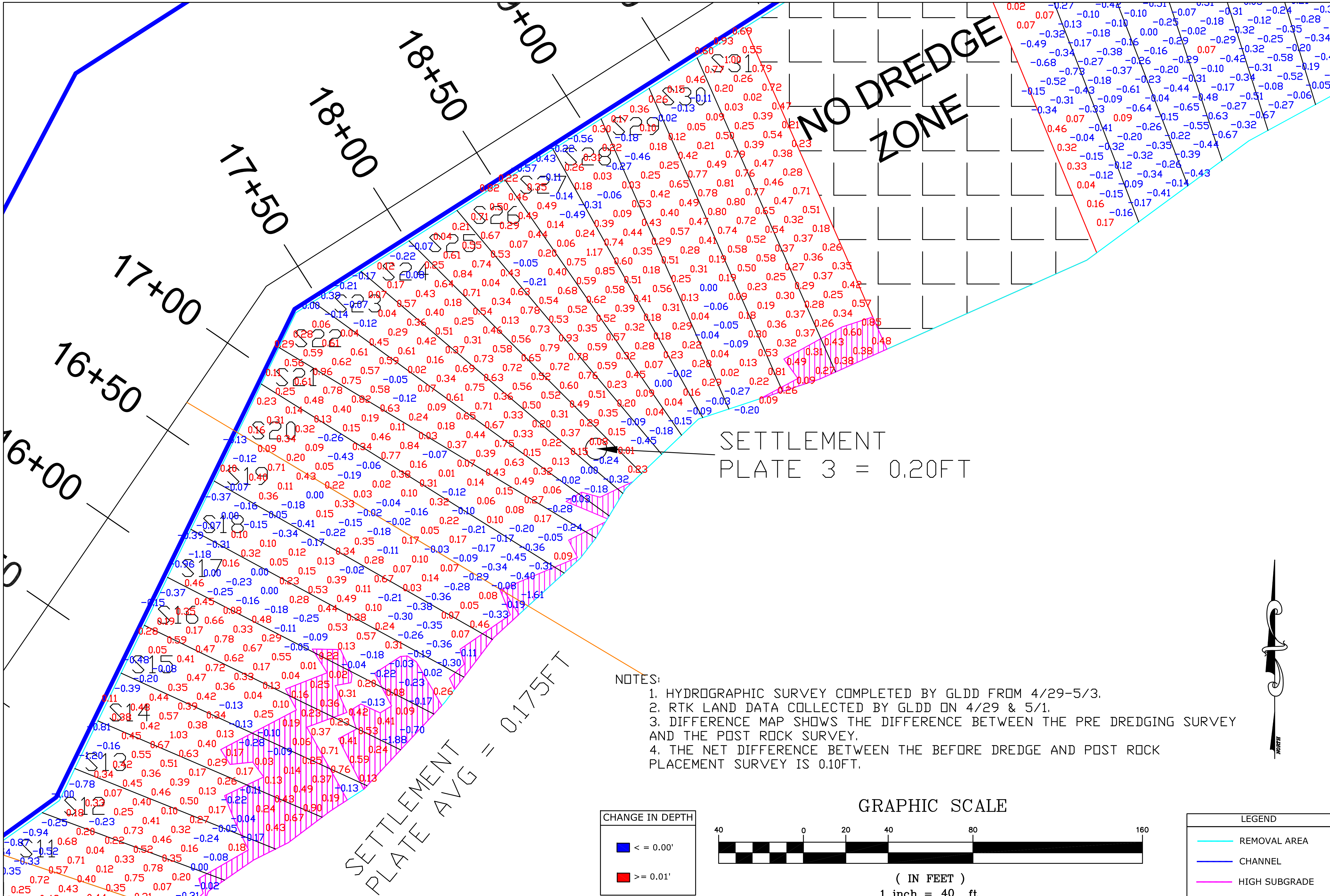

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TITLE/SURVEY TITLE: PRE DREDGE TO POST ROCK PG2

SCALE:	1:40
DATE:	MAY 6, 2014
GLDD JOB NO:	15368
USACE JOB NO:	NA
FILE NAME:	15368_140504_POST_ROCK_OVERVIEW.dxf
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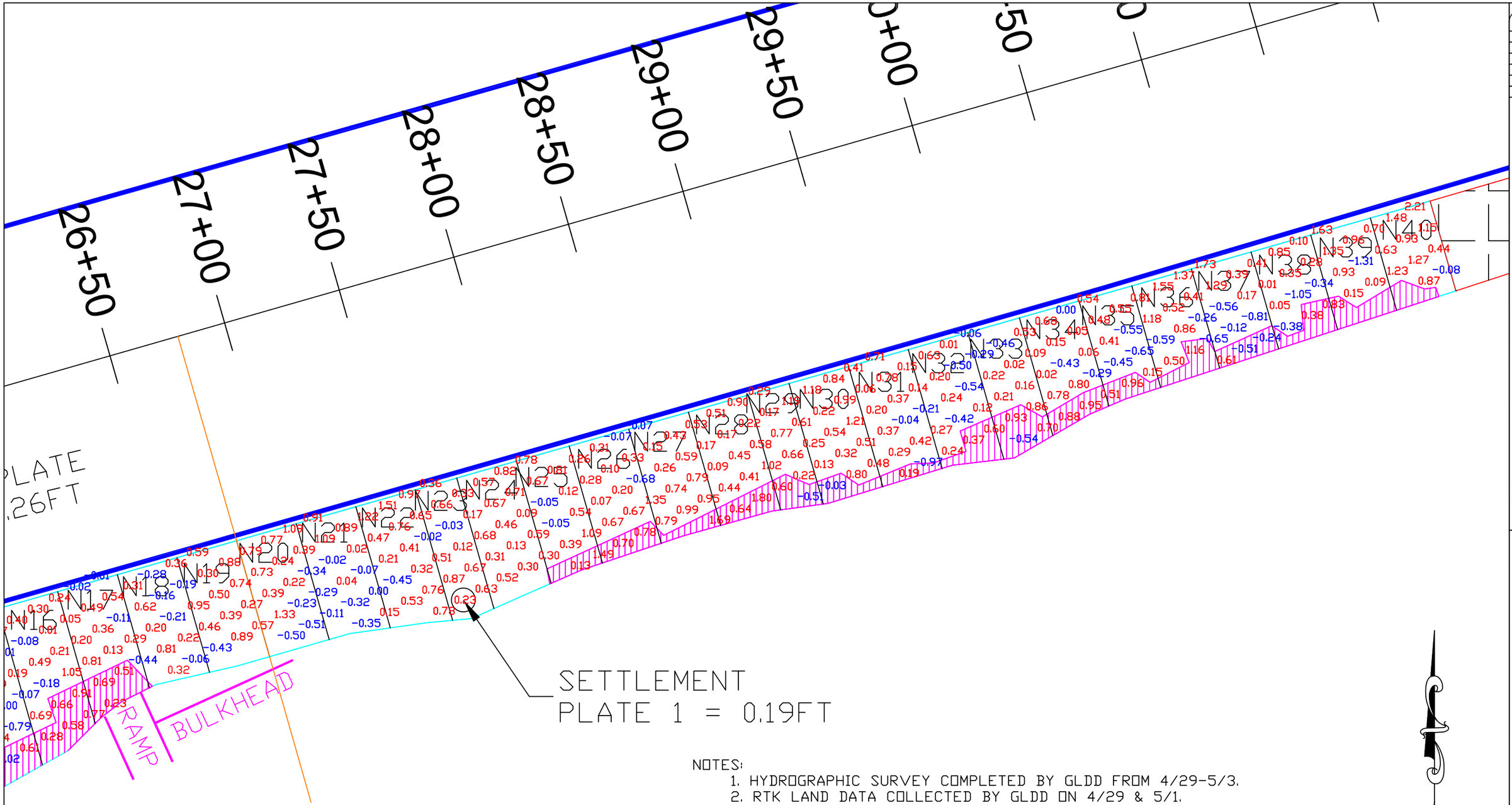

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- REMOVAL AREA
- CHANNEL
- HIGH SUBGRADE

NORTH

REVISIONS

DESCRIPTION	DATE

GREAT LAKES DREDGE AND DOCK COMPANY, LLC
2122 York Road Oak Brook IL 60521
CIVIL ENGINEERING/ SURVEYING DIVISION
Phone: 630.574-3000 Fax: 630.574-1515

PROJECT
LOWER PASSAIC RIVER, NJ
STUDY AREA PROJECT, RIVER MILE 10.9

TITLE/SURVEY TITLE
PRE DREDGE TO POST ROCK PG4

SCALE:	1:40
DATE:	MAY 6, 2014
GLDD JOB NO:	15368
USACE JOB NO:	NA
FILE NAME:	
DESIGNED BY:	J. MILLER III
APPROVED BY:	J. MILLER III

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